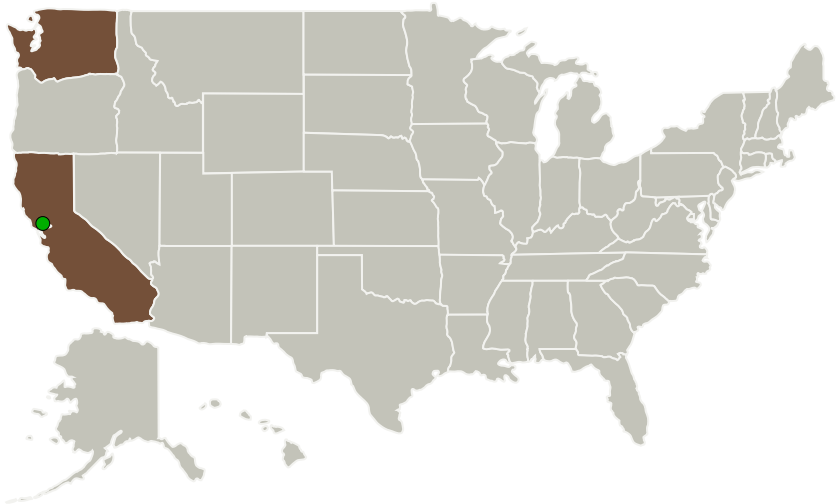
Scalable, Lightweight, Low-Cost Aero/Electrodynamic Drag Deorbit Module, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

The proposed effort will develop the "Terminator Tape Deorbit Module", a lightweight, low-cost, scalable de-orbit module that will utilize both aerodynamic drag enhancement and electrodynamic drag to rapidly remove small satellites from LEO altitudes, enabling compliance with orbital lifetime restrictions such as NSS 1740.14 and DoD Instruction 3100.12, Sec. 6.4. Unlike de-orbit devices that rely solely upon aerodynamic drag, which provide no significant reduction in the probability of collision with another space object during orbital lifetime, the Terminator Tape's generation of electrodynamic drag can dramatically reduce the Area-Time-Product of the system, minimizing chances of debris-generating collisions. The proposed Terminator Tape design utilizes space-qualified materials, requires only standard pyro signals from the host spacecraft for activation, requires no internal avionics, and its deployment method has already been demonstrated successfully in microgravity. It can also accommodate installation of solar cells or other devices on its surface to minimize footprint impacts on small spacecraft. It can also be configured to serve as a multifunctional element, acting as multi-layer insulation (MLI). Positive control of de-orbit timing is provided through a simple actuation requiring only a pyro signal. The device is readily scalable from picosats up to large spacecraft, and in the proposed effort, we will develop a flight ready prototype sized for testing on a CubeSat as well as detailed designs of modules sized for 15 kg nanosats and 100 kg microsats. We will also investigate and test innovative methods for maximizing electrodynamic current, including photoemissive and low-work-function thermoelectric materials. These Phase I efforts will prepare us to perform a flight test on a CubeSat or other low cost platform in the Phase II effort.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Tethers Unlimited Inc	Lead Organization	Industry	
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Washington

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138481)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Tethers Unlimited Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert P Hoyt

Co-Investigator:

Robert Hoyt

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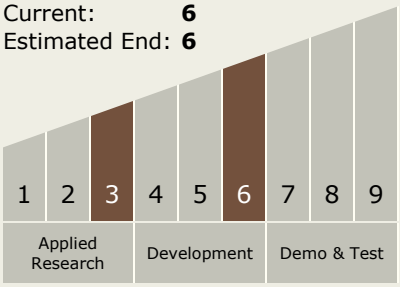
Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.3 Passive Reentry Systems for SmallSats

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System